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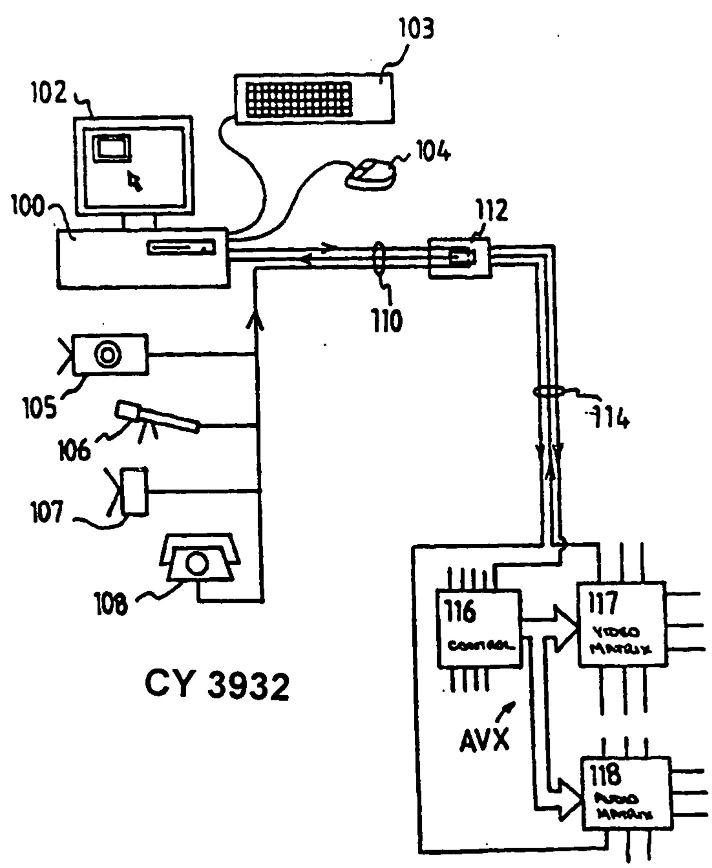
(54) Title: VIDEO-TELEPHONY COMMUNICATION APPARATUS

(57) Abstract

At a video-telephony station control signals are generated e.g. by a mouse (104) or keyboard (103) and are sent to a remote audio-video exchange (AVX) together with video signals from a camera (105) and telephony traffic from a microphone (107) or telephone handset (108) for example. The AVX includes a control device, e.g. a microcontroller (116), which responds to the control signals to control telephony and video switching networks (117 and 118) to ensure parallel routing of the audio and video traffic.



CY 3932

CY 3933

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VIDEO-TELEPHONY COMMUNICATION APPARATUS

TECHNICAL FIELD OF THE INVENTION

This invention relates to video-telephony communication apparatus by which two or more remotely located stations can communicate with each other via simultaneous audio and video links.

BACKGROUND

Video-telephony systems of reasonable quality are largely digital. They make use of specialised compression techniques to reduce the required bandwidth, and are expensive. Furthermore, current compression techniques only allow a maximum of 20 frames per second using conventional digital telephony links (e.g ISDN 2 cabling). Much better picture quality in obtainable when the available bandwidth is increased, but the installation of ISDN 30 cabling, or its equivalent, is prohibitively expensive for small users.

GB 2 253 120-A discloses a video-telephony communication system in which the routing of video signals is controlled from the call logging or data channel of a telephone exchange (PABX). However, this requires the installation of separate video cabling in addition to

the telephone wiring, which can be a major undertaking. in addition, it is a very complex task to implement the telephony protocols to achieve reliable control of the video channel.

An aim of the present invention may be viewed as being to devise a system of high quality video-telephony which is inexpensive to implement.

SUMMARY OF THE INVENTION

The present invention proposes video-telephony apparatus in which manual input means is arranged to generate digital control signals at a user station which are sent to a combined audio-video exchange together with telephony and video signals from the user station. The exchange includes a telephony switching network which is operated by the control signals via control means in parallel with a video switching network to route the telephony and video signals together.

By operating the exchange in response to control signals generated at the user stations to route the video and telephony signals in parallel, great simplification of the control protocols is achieved, giving lower cost and greater reliability. Moreover, a number of user stations can be linked to the exchange using pre-existing data cabling to carry the control, video and telephony traffic so that the installation costs can be low. Longer range communication can be achieved by linking the exchange to high grade data networks via suitable analogue-digital encoders (codecs).

BRIEF DESCRIPTION OF THE DRAWINGS

The following description and the accompanying drawings referred to therein are included by way of non-limiting example in order to illustrate how the invention may be put into practice. In the drawings:

> Figure 1 is a block diagram of a single video-telephony station and audio-visual exchange for use in a video-telephony system of the invention,
>
> Figures 2A and 2B are detailed block circuit diagrams of an encoder forming part of the video-telephony station, and of the exchange, shown separately for convenience,
>
> Figure 3 is a block diagram of a second form of the video-telephony station, and
>
> Figure 4 is a schematic diagram showing a station and exchange incorporated in a video-telephony system.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Fig. 1, an analogue audio-video exchange 8 (AVX) is arranged to route telephony and video signals between several similar user stations, only one of which is shown for convenience.

CY 3936

At each user station, an encoder 10 receives dialling tones from a conventional DTMF (Dual Tone Multiple Frequency) dialling keypad 12 in accordance with the keys which are depressed. The encoder 10 generates a binary coded output at 14 according to the tones received, which are used to control routing of the telephony and video signals by switching networks in the exchange. A conventional hook switch 18 is operated by a telephone handset 3 to enable the encoder 10, and to drive logic generators 20 which in turn enable the switching networks via line 22.

More detailed block diagrams of the encoder 10 and AVX unit 8 are shown in Fig.s 2A and 2B. In the encoder 10, multiple-tone input from the keypad 12 is sent to a pre-processor and band-splitting filter 30 which in turn feeds detector and signal processing circuits 32 via bandpass filters 34 and 36. The circuit 32 is enabled by input from the hook switch 18 to generate binary switching control logic 0-4 for control of the switching networks. The encoder 10 also includes a clock generator 38 and voltage regulators 40.

The AVX unit 8 is shown in Fig. 2B and includes a decoder/latch 42 which decodes the control logic 0-4 to produce a 16-pole switching output. The decoder can be enabled or disabled by the control logic arriving at 22 from hook switch 20. The switching output simultaneously controls a pair of identical 4x4 matrix switches 44 and 46 which in turn control the input/output routes of the video and telephony channels respectively. (It will be appreciated that although 4X4 switches have been mentioned for the purpose of

illustration any suitable switching combination can be used.) The audio switching networks can also be used to route two-way telephony communication between the AVX and a conventional PBX (telephone exchange) if desired.

It will be appreciated that in most cases the AVX 8 will be located remotely from the user stations which include specially set up and positioned cameras 4 and either stand-alone monitors or personal computers 5. All of the video cabling between the station and the AVX can be made with 75 ohm coaxial line or similar, with the control signals being sent via standard data cabling. An advantage of the present system however is that, by using suitable video baluns both the analogue video and telephony cabling can be carried out using 100 ohm data grade RJ45 cabling or similar.

By keying the appropriate numbers via the keypad 12, individual internal or external calls can be made by voice only, voice-and-video (one and two way) or multiple voice/video conferencing. Audio-only communication can be by telephone handset or hands-free.

Fig. 3 shows another form of the video-telephony station which is based on a personal computer 100. The computer will generally be of the IBM family, although other types may be used. The computer is provided with a screen 102, a keyboard 103 and a mouse 104 in the usual arrangement. (The mouse could be replaced by a trackball or equivalent.) A video card is inserted into one of the free expansion slots of the computer to manipulate incoming video signals into a form suitable for display.

The station further includes a video camera 105 to receive the image of the station user, together with audio input and output equipment in the form of a microphone 106 and a speaker 107, and/or a conventional telephone 108. The video and audio equipment 105-108 need not be directly linked to the computer 100, although it will generally be more convenient to do so, as will be explained below. Video signals from the camera 105 together with audio input signals from the microphone 106 and/or telephone 108 are routed via a short lead 110 to a data socket 112, which is normally used to send data around a building via data grade "twisted pair" cabling 114, e.g. 100 ohm, 4 pair, category 5. The cabling 114 leads to switching networks 117 and 118 for video and audio signals, incorporated in a remote AVX. The AVX receives input from a number of similar stations at various locations in the building and may also be linked to an external communication network via a suitable analogue-digital codec if desired.

A communication port of the computer 100 is configured to send digital control signals from the computer to the AVX via a separate twisted pair of the cabling 110 and 114. The AVX includes a microcontroller-based control unit 116 which receives the digital signals and interprets them to control the switching networks 117 and 118 to route the incoming and outgoing audio and video signals in parallel to the same destination.

Incoming audio/video signals from the AVX are routed to the video-telephony station along a separate twisted pair in the leads 114 and 110. The incoming video

images are processed by the video card for display by the monitor 102. The incoming telephony signals are sent to the speaker 107 and/or telephone 108, as desired, or alternatively, they may be sent to a sound card installed in the computer for output by associated speakers (not shown).

The station is typically operated as follows.

To establish communication with another station a communication icon 20 (Fig. 1) is called up on the display screen, either directly in the computers software operating system (e.g. MS-DOS) or through a graphical interface such as Windows (Microsoft Trade Mark). By using the mouse to point and click on the icon, or by hitting an appropriate key combination on the keyboard, a required destination address is generated. This can either be done by entering a full dialling code for the destination station, or by selecting pre-programmed quick-dial keys, for example. The destination address is interpreted by software in the computer into a suitable serial data stream (e.g. ASCII), which is in turn sent from the serial port down the cabling 114 to the AVX. The data stream will also identify the sending station by means of an allocated address code.

When the data arrives at the AVX controller 116 they are decoded and used to control the switching network 117 to connect the audio and video signals from the sending station to the desired receiving station. At the receiving end, the visual image signals processed by the video card are displayed in a window in the receiving

computers monitor, and a visual and audible alert is produced. The operator at the receiving end can then hit a designated keyboard key, or point and click with the mouse on a displayed icon, to open the audio-visual link in the reverse direction via the AVX, audio communication being carried out using the telephone, with hands-free if desired, or using microphone and speaker, or a combination of these.

A non-visual audio link can be set up using the appropriate software commands if desired by either party. All functions are preferably controlled by the mouse and/or keyboard. It will generally be desirable to route the outgoing audio and video signals through the computer 100 to allow full software control over the outgoing signals. This also allows a thumbnail sample of the outgoing image to be displayed on the screen 2 along with the incoming image. It is not essential for the incoming audio signals to be routed through the computer 100, although again, this is desirable to allow full software control over the incoming signals.

It will be appreciated that the data signals generated by the computer may be sent to the AVX via the same twisted pair as the audio/video signals by using band-separation techniques or by sending the data bits between the line or frame pixel data of the video signals for example. Further, the audio signals could be sent down a separate twisted pair from the video signals.

The computers can also be used to run additional software applications, and by using suitable multi-

tasking software the communication and other applications can be run simultaneously.

In both of the systems described above, the AVX unit can be used as a main control centre for a video conferencing network. The addition of a 2 Mbit video codec 50 as shown in Fig. 4 allows the AVX to route audio and video signals to a digital PBX 52 for connection to an external ISDN 30 link or similar high quality data network. Thus, high quality video-telephony signals can be sent and received over greater distances.

A composite video signal can be sent or received around the internal audio/visual network allowing the use of video recorders (VCRs) for recording conferences or playing of pre-recorded tapes. Security cameras can be connected into the system, either internally or externally and VCRs operated to record or playback again either internally or externally. Because the system allows video transmission along inexpensive data grade cabling, a versatile network of cameras, screens, VCRs, computers etc, can be connected and reconnected via flood wired data grade cabling. Interconnections can be made via patch panel links in the communication centre to the AVX is much the same way as an conventional data networks.

An internal video telephony or conferencing system operating purely in analogue mode is therefore possible at relatively low cost using full motion video. The system can also be linked to external high quality communication networks when required.

CY 3942

CLAIMS

1. Video-telephony communication apparatus comprising:

- a video-telephony user station which includes:
  manual input means (12; 103; 104)
  telephony input means (106; 108) for receiving the voice of a user,
  a video camera (105) for receiving the image of a user, and
  a display monitor (102);
- an exchange (AVX) which includes:
  a video switching network (44; 117), and
  control means (42; 116) for controlling the switching network;

characterised in that

the manual input means (12; 103; 104) is arranged to generate digital control signals at the user station which are sent to the exchange together with telephony and video signals from the user station, and said exchange includes a telephony switching network (46; 118) which is operated by the control signals via said control means (42; 116) in parallel with the video switching network (44; 117) to route the telephony and video signals together.

2. Video-telephony communication apparatus in accordance with Claim 1, in which the control signals are sent to the control means (42; 116) as a binary data stream.

CY 3943

3. Video-telephony communication apparatus in accordance with Claim 2, in which the binary data stream is generated from DTMF dialling tone signals.

4. Video-telephony communication apparatus in accordance with Claim 2, in which the binary data stream is generated by a computer (100) at the said user station.

5. Video-telephony communication apparatus in accordance with Claim 4, in which the computer (100) is arranged to process the incoming video images for display on the monitor (102).

6. Video-telephony communication apparatus in accordance with Claim 4, in which the manual input device (103; 104) comprises a mouse, trackball or keyboard.

7. Video-telephony communication apparatus in accordance with Claim 1, in which said data signals identify both the sending station and a destination station selected from a plurality of further user stations connected to the exchange.

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CY 3944

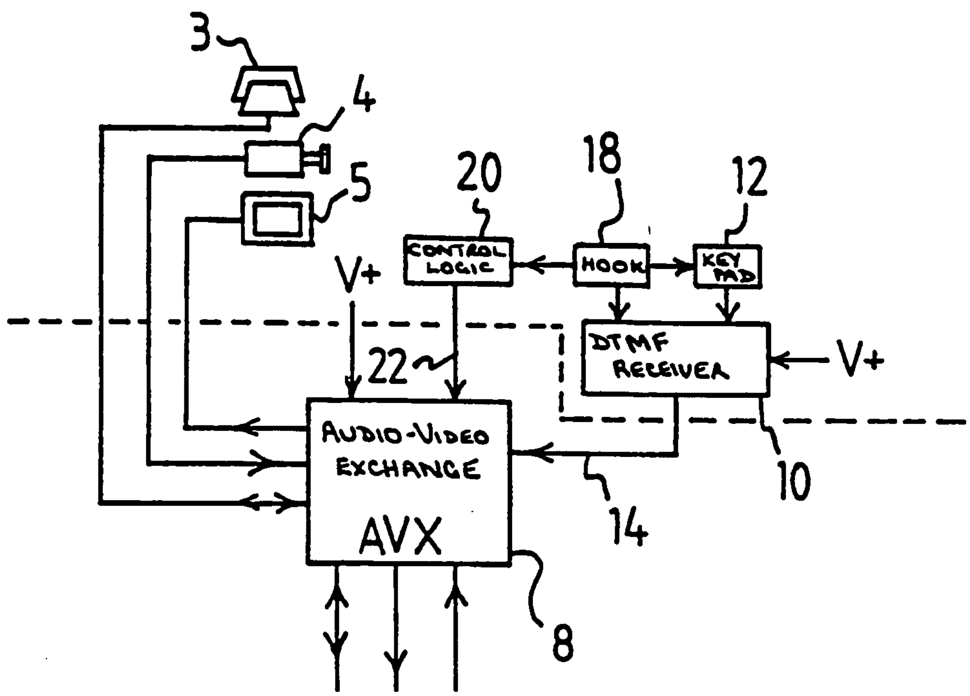
3
4
5
20
18
12
CONTROL LOGIC
HOOK
KEY PAD
V+
DTMF RECEIVER
V+
22
AUDIO-VIDEO EXCHANGE
AVX
14
10
8

FIG 1

CY 3945

2/4

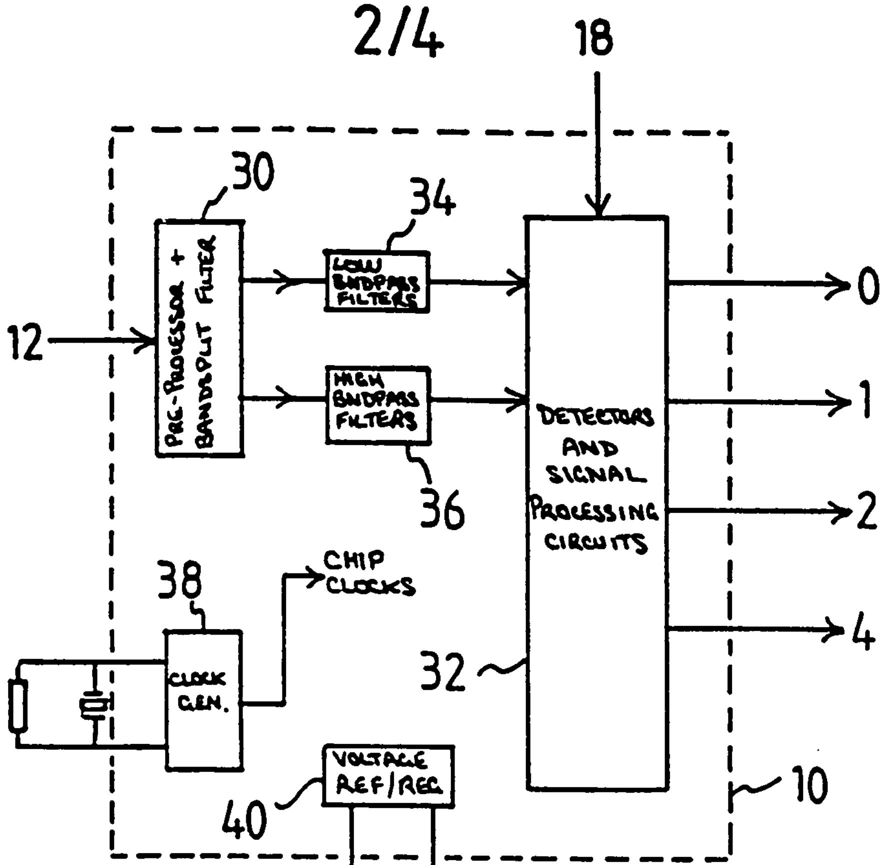

FIG 2A

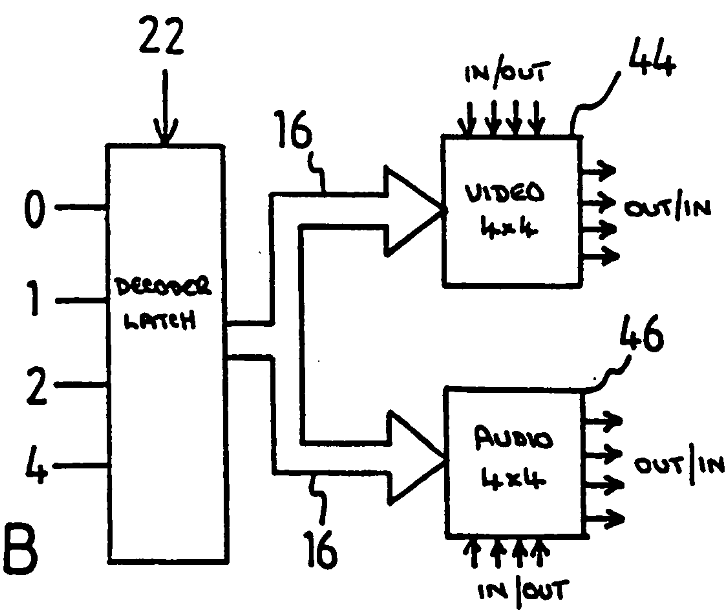

FIG 2B

CY 3946

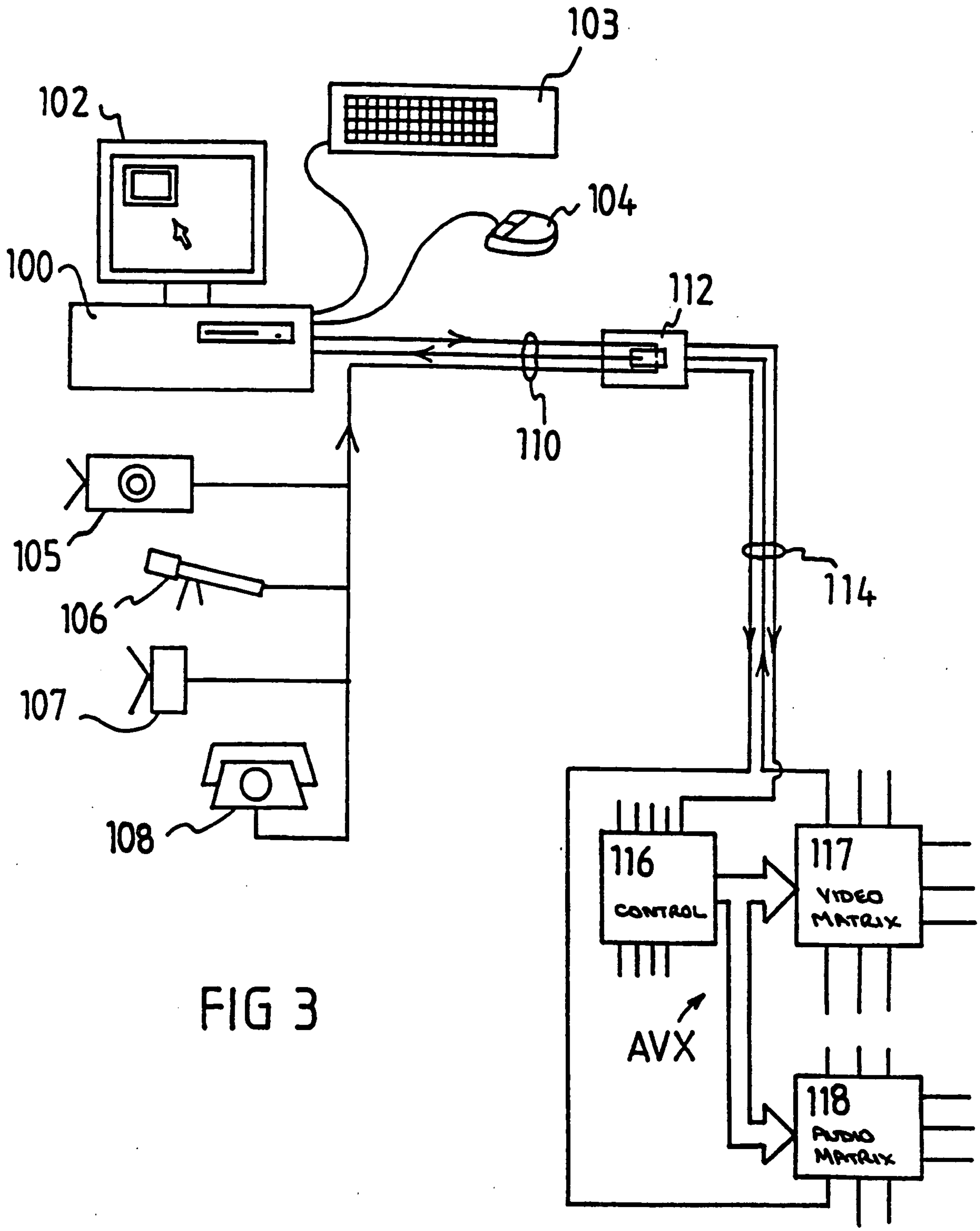
103
102
104
100
112
110
105
106
114
107
108
116
CONTROL
117
VIDEO
MATRIX
AVX
118
AUDIO
MATRIX

FIG 3

CY 3947

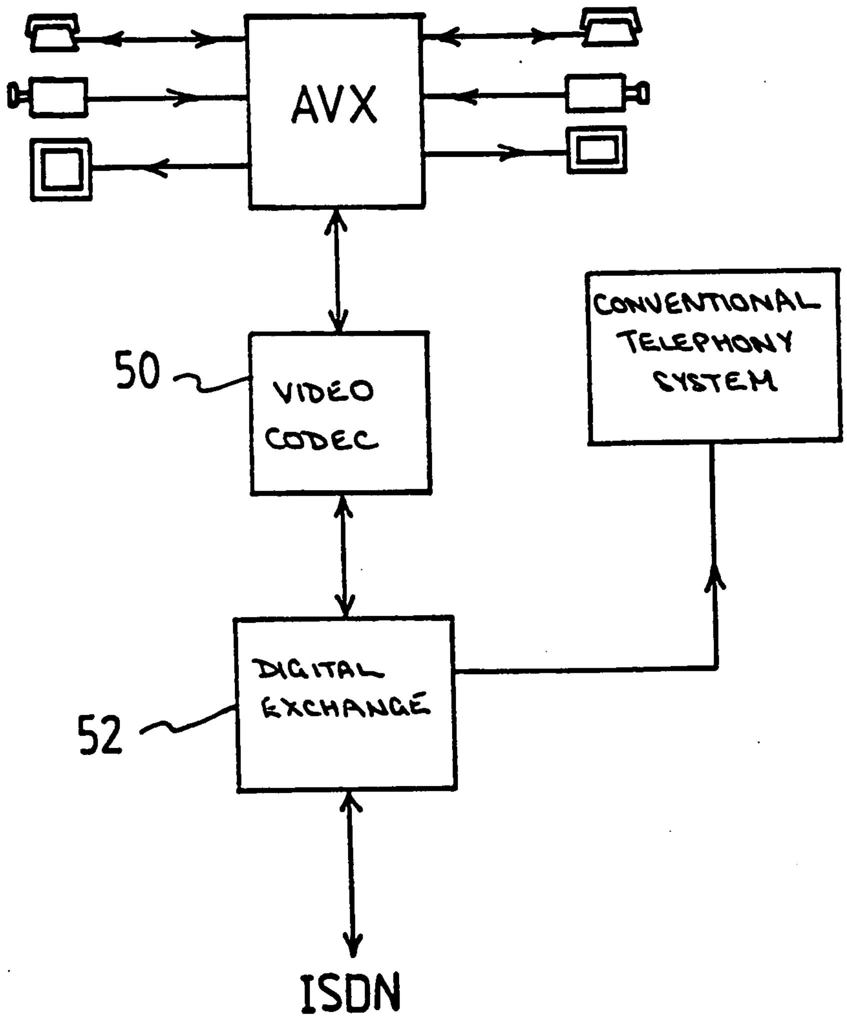
AVX
50
VIDEO
CODEC
CONVENTIONAL
TELEPHONY
SYSTEM
52
DIGITAL
EXCHANGE
ISDN

FIG 4

CY 3948